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GROWTH PERFORMANCE AND BLOOD INDICES OF BROILER FINISHER BIRDS FED ENZYME-FORTIFIED (MAXI GRAIN) RICE MILLING WASTE

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ABSTRACT
An experiment was conducted to evaluate the effect of enzyme fortified (Maxi grain) rice milling waste on the performance and blood indices of finisher broilers. The enzyme fortified (Maxi grain) rice milling waste was used to make broiler finisher diets at 0.0%, 5.0%, 10.0%, and 15.0% inclusion levels, respectively. These were then used to raise groups of 30 broiler finishers in a completely randomized design (CRD) for 4 weeks (28 days). At the end of the 28 days feeding trial, 3 birds were selected from each group for blood indices evaluation. The average daily weight gain and average daily feed intake showed no treatment effect (P > 0.05). The feed conversion ratio was significantly increased (P < 0.05) at 10% and 15% dietary levels. The feed cost per kg meat was lowest at 15.0% dietary levels. There were no treatment effect on all the haematological and some serum biochemical indices analysed. It was therefore concluded that enzyme fortified (Maxi grain) rice milling waste can serve as feed ingredient at 10% - 15% dietary levels due to cost effectiveness.

Keywords: Performance, blood indices, broiler finisher, enzyme, rice milling waste
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INTRODUCTION

There is no doubt that the cost of providing feed and drugs in livestock and poultry industry in Nigeria are steadily increasing (Esiegwu *et al.*, 2013). Some agro-industrial by-products, if carefully processed and incorporated in animal rations could supply some energy, proteins, vitamins and minerals that would enhance performance and reduce cost of production. Agro-industrial by-products are important feed components in poultry diets in Nigeria mainly due to the increased competition for the conventional ingredients by humans and the food industries (Iyayi and Davies, 2005). Rice milling waste (RMW) is one of those by-products that could be of value to livestock and poultry.

Rice milling waste, the by-product of rice milling process which contains the bran, polishing, husk and small quantities of broken grains constitutes about 40% of paddy rice and is available in large quantities in the major rice growing areas of Nigeria (Dafwang and Damang, 1995). The

main by-products of rice milling are rice hulls or husk, rice bran and broken rice of which the rice husks, the major part of RMW contains about 3.66 kCal/g energy, 5.25% crude protein and 33.1% fibre (IRRI, 2008). Adeyina *et al.* (2016) reported the proximate composition of rice milling waste to contain 91.09% dry matter, 7.32% crude protein, 1.82% ether extract and 18.00% crude fibre. Similarly, Ani *et al.* (2013) reported that rice milling waste contains 93.65% dry matter, 6.35% moisture, 5.25% crude protein, 33.18% crude fibre, 3.9% ether extract, 23.15% ash and 28.17% nitrogen free extract. The use of rice milling waste in monogastric animal feeding is not very popular because of its high fibre content and the presence of some anti-nutritional factors that inhibit the effective utilization of nutrients. High fibre content in diet interferes with nutrient availability at tissue level (Adejinmi, 2007). Rice milling waste is known to contain anti nutritional factors such as phytic acid, lectin and trypsin inhibitors (Liener, 1986). Broiler, a simple stomach animal does not tolerate high level of fibre. There is need therefore, to employ the services of enzyme in their diet in order to enhance the breakdown of the non-starch polysaccharides (NSPs) present in fibre.

Enzymes have been known to improve livability, feed conversion ratio and weight gain in broiler chickens (Okorie *et al*., 2017). Enzymes also improve the productive value of fiber feedstuffs (Augustine *et al.*, 2011). Maxigrain is an exogenous enzyme that contain blend of most relevant digestive enzymes non-soluble polysaccharides (NSPs) enzymes and phytase that bring about efficient utilization of wide range of agro-industrial by-products like cassava peel meal (Aguihe *et al.*, 2014). Maxigrain is a multi-enzyme compound of B-glucanase, xylanase, phytase, arabinoxylanase and a mixture of yeast and minerals, and it originates from the bacteria *Aspergillus oryzae* (Alu *et al*., 2012; Ogungbesan *et al*., 2014).

The study therefore was aimed at investigating the growth performance and blood indices of finisher broiler birds fed enzyme-fortified (maxi grain) rice milling waste.

MATERIALS AND METHODS

This experiment was carried out at the poultry unit of teaching and research farm, Imo State University Owerri, which is located within the South-Eastern agro-ecological zone of Nigeria. Owerri lies between latitude $5^0$29'North and longitude $7^0$20'East. It is about 91m above sea level with annual rainfall, temperature and humidity ranging from 1,500mm to 2,200mm, 20.0 – 27.5^{0}C and 75 – 90%, respectively (Accuweather, 2015).

The rice milling waste was bought from a reputable source in Ekeonuwa market in Owerri, Imo State. The enzyme - Maxigrain was incorporated into the rice milling waste at the rate of 0.01% inclusion levels for all the treatment diets except the control. Samples of the rice milling waste were taken to the laboratory for proximate analysis according to AOAC (2010). Before the incorporation of the enzymes, an enzyme potency test was carried out by dissolving the enzymes

in 50 centilitre of water. This was poured into the cellulose in a container and allowed to stand for 12 hours in which the cellulose dissolved showing that the enzyme was active (positive). Four finisher broiler diets were compounded, incorporating the rice milling waste fortified with enzyme - Maxigrain at 0%, 5.0%, 10.0% and 15.0% inclusion levels respectively, partly replacing maize in the control diet. The diets were thus designated as T_0, $T_{5.0}$, $T_{10.0}$ and $T_{15.0,}$ respectively. The ingredient and calculated nutrient composition of the diets are shown in Table 1.

One hundred and twenty (120) 4 - weeks old Marshal broiler chicks bought from a reputable dealer in Owerri were used for the trial. The birds were randomly divided into four groups of 30 broilers and each group randomly assigned to one of the four treatment diets in a completely randomized design (CRD). Each group was further subdivided into three replicates of 10 broilers each and each replicate housed in a deep litter compartment measuring 1m × 1.5m. Feed and water were provided *ad libitum*. The trial lasted for 28 days. The birds were weighed at the beginning of the experiment to obtain their initial body weights and weekly, thereafter. Daily feed intake was determined by subtracting the weight of leftover feed from the weight of the feed given the previous day. Data were collected on feed intake, body weight gain and feed conversion ratio. Feed conversion ratio was calculated by dividing the average daily feed intake by average daily weight gain. Blood samples were collected from 3 birds per treatment at the end of the experiment from the wing web of the birds using syringe and needle and placed in the specimen bottles with EDTA (Ethylene Diamine Tetra Acetate) for haematological studies and some placed in the specimen bottles without EDTA for biochemical studies. Haematological and some serum biochemical indices were analysed according to the method outlined by Ochie and Kolhatkar (2000).

Data collected were subjected to analysis of variance using the SPSS software (2012). Where analysis of variance indicated significant treatment effects, means were compared using Duncan's New Multiple Range Test (DNMRT) (SPSS, 2012).

RESULTS AND DISCUSSION

Proximate composition

The proximate composition of the rice milling waste (RMW) are shown in Table 2. The crude protein (CP, % DM), crude fibre (CF), ether extract (EE), ash and nitrogen free extract (NFE) were close to the values 5.25% CP, 33.18% CF, 3.9% EE and 28.17% NFE reported by Ani *et al*. (2013). However, the proximate values varied more from the report of Olusiyi and Wafar (2017) containing 8.75% CP, 36.99% CF, 20.12% ash, 5.14% EE, and 25.66% NFE. These variations in nutrient compositions could be due to climatic conditions, edaphic factors as well as methods of processing and laboratory analytical procedures (Taiwo *et al*., 2005).

The performance characteristics of finisher broilers fed enzyme fortified rice milling waste are shown in Table 3. The data showed that there were no significant treatment effect ($P > 0.05$) on the average daily feed intake and average daily weight gain. The feed conversion ratio was significantly increased ($P < 0.05$) at 10% and 15% dietary levels. The feed cost per kg meat was lowest at 15.0% dietary levels.

Manafi *et al*. (2011) reported that broiler finishers fed enzyme supplemented diets have increased feed intake due to increased nutrient digestibility, however, Oladunjoye and Ojebiyi, (2010) reported decreased feed intake for broilers on enzyme supplemented diets as a result of fulfilling their nutrient requirements by taking less amount of feed. Generally speaking, consumption is a function of the physiological state of the birds, the age of the birds, the breed, the season, the nature and palatability of the feed. The findings in this study is in line with the report of Abu *et al.* (2011) who observed no significant difference across dietary treatments for daily feed intake, weight gain and feed conversion ratio for broiler finishers fed diets supplemented with Roxazyme G and exogenous phytase but contradicted the report of Ani *et al*. (2013) for enzyme supplemented rice milling waste fed to broiler chicks in starter ration. According to Ani *et al.* (2013), it resulted in a significant ($P < 0.05$) reduction in feed intake and enhanced significantly ($P < 0.05$) the performance of the broiler chicks that consumed such enzyme supplemented diets.

Data on the haematological and some serum biochemical indices of broiler finishers fed enzyme fortified rice milling waste are shown in Tables 4. The result showed that there were no treatment effect ($P > 0.05$) on all the haematological and some serum biochemical indices analysed. This was an indication that rice milling waste fortified with maxigrain enzyme had no deleterious effect on the blood indices of broiler finishers and could serve as a suitable energy substitute in broiler finisher diet.

CONCLUSION AND RECOMMENDATION

It was concluded that for cost effectiveness in broiler production, 10.0% to 15.0% enzyme fortified rice milling waste could be incorporated in broiler finisher diet. The diet did not exhibit any detrimental signs to the blood indices of the birds.

Therefore, it was recommended that the use of enzyme fortified rice milling waste as an alternative energy source in the diet of broilers should not exceed 15.0% inclusion level because of its cost effectiveness at this level.

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APPENDIX

Table 1: Ingredient and calculated nutrient compositions of the experimental diets

Ingredients	**Dietary levels of enzyme fortified RMW**			
	T_1(0.0%)	**T_2(5.0%)**	**T_3(10.0%)**	**T_4(15.0%)**
Maize	55	50	45	40
Rice milling waste	0	5	10	15
Soya bean meal	16	16	16	16
Groundnut cake	5	5	5	5
Palm kernel cake	10	10	10	10
Wheat offal	5	5	5	5
Fish meal	2	2	2	2
Blood meal	2	2	2	2
Bone meal	4	4	4	4
*Vitamin premix	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25
Di-Methionine	0.25	0.25	0.25	0.25
Calculated chemical compositions of experimental diets				
Crude protein	19.66	19.52	19.37	19.22
Crude fibre	4.38	5.75	7.14	7.84
Ether extract	4.27	4.09	3.92	3.74
Calcium	1.60	1.60	1.60	1.60
Phosphorus	1.13	1.12	1.10	1.01
Lysine	1.21	1.20	1.19	1.11
Methionie	0.61	0.60	0.58	0.52
Metabolizable Energy kcal/kg	2848.04	2756.20	2664.35	2572.51

*Provided the following per kg of feed; vitamin A, 1000iu; vitamin D3, 1500iu; vitamin E, 51mg; vitamin K, 2mg; Riboflavin, 3mg; Pantothenic acid, 10mg; Nicotinic acid, 25mg; Choline, 350mg; Folic acid, 1mg; Mg, 56mg; Iodine, 1mg; Fe, 20mg; Zn, 50mg; Co, 1.25mg.

Table 2: Proximate composition of rice milling waste

Nutrient % DM	**Composition**
Crude fibre	30.29
Crude protein	6.02
Ash	24.0

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Ether extract	3.81
Moisture	6.00
Nitrogen free extract	29.88
Dry matter	93.00
ME (Kcal/kg)	1595.14

Table 3: Performance of broiler finishers fed rice milling waste fortified with Maxigrain enzyme

Parameters	**Dietary Treatments**				
	T1 (0%)	**T2 (5.0%)**	**T3 (10.0%)**	**T4 (15.0%)**	**SEM**
Average initial body weight (g)	770	750	730	760	27.00
Average final body weight (g)	2000	1960	1910	1890	68.00
Average daily weight gain (g)	43.93	43.21	42.14	40.36	3.00
Average daily feed intake (g)	95.00	102.00	112.00	120.00	6.00
Feed conversion ratio	2.16^{c}	2.36^{bc}	2.66^{ab}	2.97^{a}	0.15
Feed cost /kg (#/kg)	94.91	79.20	65.08	53.64	
Feed cost /kg meat	308.72	273.81	237.23	189.23	

^{abc}Means within the same row with different superscripts are significantly ($P < 0.05$) different.

Table 4: Haematological indices of broiler finisher fed rice milling waste fortified with Maxigrain enzyme.

Parameters	T1 (0%)	Dietary T2 (5.0%)	treatments T3 (10.0)	T4 (15.0%)	SEM
Haemoglobin (g/dl)	9.40	10.05	10.15	9.10	0.28
Packed cell volume (%)	26.45	28.15	28.75	25.20	0.85
Red blood cell ($x10^{6}$/ul)	2.70	2.53	3.02	2.64	0.10
Mean cell volume (fl)	97.40	100.25	95.10	95.35	1.31
Mean cell haemoglobin concenteration (g/dl)	35.65	34.80	36.30	36.05	0.25
Mean cell haemoglobin	34.70	36.35	34.55	34.40	0.36

(pq)					
White blood cell ($x10^9$/l)	9.05	9.06	9.06	9.05	0.01
Lymphocytes (%)	94.00	90.00	90.50	89.50	1.25
Neutrophils (%)	5.50	9.50	9.50	10.50	1.31
Eosinophils (%)	0.00	0.00	0.00	0.00	0.00
Monocytes (%)	0.00	0.00	0.00	0.00	0.00
Basophils (%)	0.00	0.00	0.00	0.00	0.00
Total proteins(g/100ml)	6.50	4.85	5.50	6.50	0.38
Albumin (%)	2.50	2.15	1.85	2.50	0.16
Globulin (%)	4.25	2.70	3.65	4.00	0.30
Urea conc. (mg/dl)	4.01	4.01	3.09	4.00	0.01

[ab]Means within the same row with different superscripts are significantly different ($P<0.05$)